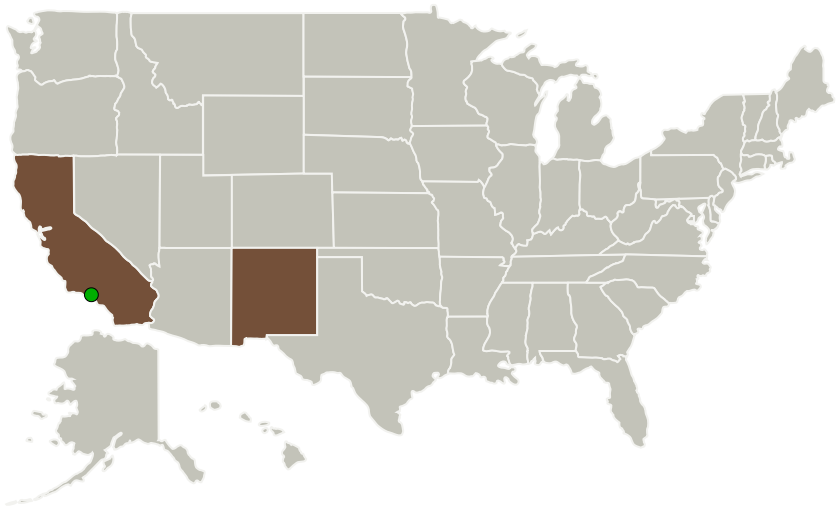
Precision Remote Sensor for Oxygen and Carbon Dioxide, Phase II

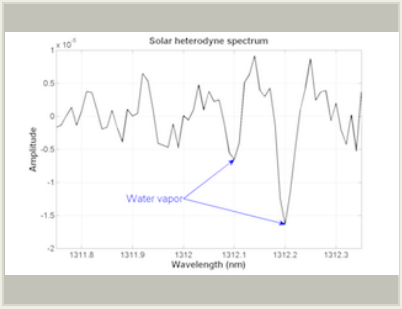
Completed Technology Project (2014 - 2017)

Project Introduction

The Phase II project will lead to the design, construction, and field-testing of a prototype PHOCS instrument for atmospheric column retrievals of oxygen and carbon dioxide. The carbon dioxide wavelength range may also be extended to add methane and carbon monoxide measurements depending on laser performance. The prototype will include the improvement to heterodyne spectroscopy invented in Phase I. The project will move Mesa Photonics' technology toward commercializing compact, portable instruments that combine high spectral resolution with high sensitivity and rapid data acquisition. The requirements for implementing a successful Phase II prototype are straightforward responses to the lessons learned in Phase I. The Phase II work plan will implement the following hardware improvements: • Mount the light collection optics on a commercial solar tracker that has a built-in GPS to simplify setup at different locations. • Replace the current external cavity laser used for the oxygen spectral range with a laser having two orders of magnitude better wavelength repeatability and an order of magnitude faster wavelength switching speed. • Eliminate the electronic noise canceller. Phase I results showed that fluctuations in collected sunlight intensity is the dominant PHOCS noise source. Laser excess noise is small in comparison. The Phase I invention does a much better job of improving sensitivity than does the noise canceller. • Switch from a narrowly tunable laser to a widely tunable one for carbon dioxide measurements. As with oxygen, the improved laser will allow fast measurements of selected absorption lines. • Consolidate the signal processing electronics onto a custom-built, compact, low-power circuit board and replace the commercial lock-in amplifier with new dual, single-board lock-in amplifier that Mesa Photonics has developed.

Primary U.S. Work Locations and Key Partners





Precision Remote Sensor for Oxygen and Carbon Dioxide, Phase II

Table of Contents

Precision Remote Sensor for Oxygen and Carbon Dioxide, Phase II

Completed Technology Project (2014 - 2017)

Organizations Performing Work	Role	Type	Location
Mesa Photonics, LLC	Lead Organization	Industry	Santa Fe, New Mexico
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	New Mexico

Project Transitions

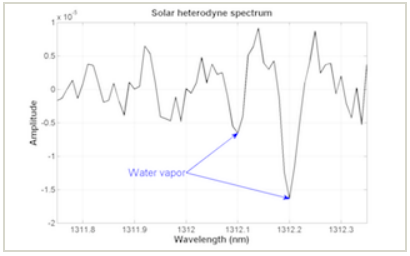
April 2014: Project Start

October 2017: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137632)*

Images



Briefing Chart Image
Precision Remote Sensor for Oxygen and Carbon Dioxide, Phase II
(https://techport.nasa.gov/image/132312)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Mesa Photonics, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

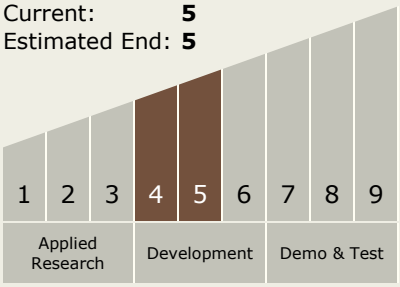
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
David Bomse

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



Precision Remote Sensor for Oxygen and Carbon Dioxide, Phase II

Completed Technology Project (2014 - 2017)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System